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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Rodney John DAVIES

Art Unit: 3672

Application No: 10/622,710

Examiner: Thomas S. Bomar

Filed: July 18, 2003

For: BORING MACHINE

TRANSMITTAL OF CERTIFIED COPY

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

This application claims priority of Australian Provisional Application No. 2002953110 filed December 5, 2002. A certified copy of the Australian provisional application is transmitted herewith in order to complete the claim for priority.

Respectfully submitted,

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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2002953110 for a patent by ROD DAVIES INFRASTRUCTURE PTY. LTD. as filed on 05 December 2002.

CERTIFIED COPY OF
PRIORITY DOCUMENT

WITNESS my hand this
Twenty-second day of July 2003

J. Billingsley

JULIE BILLINGSLEY
TEAM LEADER EXAMINATION
SUPPORT AND SALES

ROD DAVIES INFRASTRUCTURE PTY. LTD.

AUSTRALIA
Patents Act 1990

PROVISIONAL SPECIFICATION
for the invention entitled:

"BORING MACHINE"

The invention is described in the following statement:

TITLE: **BORING MACHINE**

FIELD OF THE INVENTION

This invention concerns micro-tunnelling machines of type used to bore underground drainage passages.

BACKGROUND OF THE INVENTION

Infill housing frequently requires the provision of services which cross boundaries and which must be precisely located. When the drainage is one of the services, the fall or incline must be incorporated into the final selected direction. Additionally, where line of sight is available to find the radial angle from the bore entrance to the target site, optical instruments provide accuracy. If an obstruction is encountered, an excavation may be needed to investigate. Alternatively the change in direction is planned. Every effort is made to reduce the expensive boring stage to a minimum. The use of laser technology by drainers is well established, but laser guided micro-tunnelling machines are expensive and not widely used.

SUMMARY OF THE INVENTION

The apparatus aspect of this invention provides a guidance system for the boring head of a micro-tunnelling machine of the type which bores in a selected direction and inclination using laser beam guidance having the endmost part of the drive to the boring bit adjustable in two directions at 90° wherein,

the endmost part of the drive has a target for the laser beam, means to convey an image of the target and the laser strike position thereon to an operator situated remotely from the boring head and input means for the operator to adjust the direction of the endmost part of the drive.

Means to convey the image may be a video camera. The target may be a surface against which the laser can be seen in contrast. The target may have a series of concentric rings, cross hairs or equivalent markings to help the operator to centre the direction of the boring bit.

The video camera may supply a continuous signal to a monitor at the bore entrance or at a convenient location. It is usual for the operation to require the presence of an operator to add drive extensions to the bore string. It is therefore economic to have the operator guide the bit in between intermittent string extensions. During the fitting of an add-on drive unit, the bit is not revolving.

The input means for the operator may be switches which control the adjustors which act on the drive shaft mutually at 90°. The switches may be individual, but preferably they are grouped together as slide controls, but more preferably as a joystick.

The adjustment of drive shaft direction may be achieved by hydraulic pressure supplied by the water feeding the flushing operation of the boring bit.

Control of waterflow to the hydraulics may be by solenoid operated valves. This is convenient if the hydraulic rams and the valves are grouped together in the boring head making it necessary to supply the head with a water feed conduit, low voltage electrical leads and a large bore slurry removal conduit. The moving parts may therefore be reduced to the drive shaft, the associated rams and the boring bit. This layout simplifies and cheapens the construction of the machine. It is not onerous to watch the monitor and

correct the direction of the bore intermittently. Once aligned, the bore tends to maintain course unless changes in the subsoil occur. The machine's static base is installed in the pit and its radial direction, ie. NSEW, is selected and thereafter the frame is locked in position. The sliding frame assumes the direction of the static base. The direction of the thrust imposed on the boring head is unchanged during the addition to the string of the add-on drive sections.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the invention is now described by way of example with reference to the accompanying drawings, in which:-

Figure 1 is a side view of the machine.

Figure 2 is a plan of the base and the slidable frame.

Figure 3 is a side sectional view of the boring head.

Figure 4 is an end section of the boring head in Figure 3.

Figure 5 is a cut away view of the head shown in Figure 3.

DETAILED DESCRIPTION WITH RESPECT TO THE DRAWINGS

Referring now to the drawings, once the main excavation and the target excavation have been made the direction and depth of the bore is established by drain laying practice. The main excavation pit accommodates the steel rails 2 of the base frame. The rails are joined by brace 6 which contacts the steel plate shuttering 8 lining the pit. The base frame has lugs 10 which extend on both sides toward the side of the pit and jacks 12 are inserted to position the frame radially. In addition, the base frame has a ground jack 14 to adjust its inclination. Once installed and adjusted, the rails remain static.

A sliding frame 15 engages the rails. The sliding direction conforms to the direction of the base frame and therefore is aligned with the bore path. A retractable drilling frame 16 slides on the sliding frame 15. A laser generator 17 is mounted on the steel plate 8 just above the base frame. The laser beam 18 is adjusted to reach the required point at the target site. This arrangement is standard drain layer's technology. The sliding frame has a hydraulic motor 19 which is supplied by a pump (not shown) and located near the pit (by conduits 20). The motor drives a shaft coupling 22 which is located above the slurry pipe 24, which discharges the slurry from the boring operation to a large capacity, vacuum vessel (5000l) on a truck (not shown). The vacuum tube coupling 26 lies alongside the drive coupling 22. A pair of feed rams 28 connected between the sliding frame 14 and the drilling frame 15 push the drilling frame in the feed direction and retract it to the START position. The sliding frame is locked in position in the base frame by locking pins 30 (see Figure 2) which enter bores 32 in the rails. A video monitor 34 and a control console 36 are mounted on part of the sliding frame in front of the operators

platform 38.

Referring now to Figures 3, 3A and 4, the boring head comprises a cylindrical, steel plate shell 40 which has a removable cover 42. The trailing end has a union 44 for the vacuum hose and a union 46 for the drive shaft which couple to the corresponding parts on the sliding frame and to the add-on extension units (not shown) which drainage contractors utilise in the existing art.

A bearing box 50 of the drive shaft 52 is centrally supported at the trailing end. The universal coupling 54 is located adjacent the bearing box and the drive shaft extends to the leading end of the head and beyond to the boring bit 56. The space behind the boring bit is subjected to the vacuum generated by the truck mounted installation and the slurry formed during boring enters an aperture 58 in the leading end of the shell and is removed continuously. The water which helps to form the slurry is carried through the shell by conduit 60. The water enters the drive shaft 52 via rotary coupling 62 which takes the water through a coaxial passage to multiple outlets 63 in the boring bit 64.

The shaft is free to waggle in order to correct the bore direction. The shaft aperture 65 through which the shaft projects is sufficiently large to permit 15° of angular movement. Ingress of slurry is prevented by seal 66. The adjustment of direction is achieved by suspending the shaft from two suspension points 67, 68 via a pair of double acting rams 70, 72 which are fixed to shaft sleeve 74. Between the rams is a light reflecting, aluminum target 76 showing several concentric rings. The rams are each served by conduit 78, 80 from common mains water supply 82. Twin valve assemblies 84, 86, 88,

90 control water input to the rams and water exit from the rams which exhaust into the drain 92. As the exhaust water from the rams is only a small intermittent volume, it drains into the excavated ground.

Video camera 94 illuminates and shoots the target continuously and sends a signal to the monitor. If the bit needs to rise or fall, both rams extend or retract equally. If the bit needs to move LEFT or RIGHT, one ram extends as the other ram drains. The solenoid operator valves operated on 24v dc from a joystick control on the console.

We have found the advantages of the above embodiment to be:-

1. Ram adjustment of the shaft direction using feedwater pressure is easy and economical to build and repair.

2. Camera reporting of directional accuracy is reliable and utilises operator time which must be paid for anyway.

3. Confining the electronics to a camera and monitor allows the operation in locations without diagnostic and repair facilities.

The claims, illustrations, photographs and drawings, if any, form part of the disclosure of this specification as does the description, claims, illustrations, photographs and drawings of any associated provisional or parent specification or of any priority document, if any, all of which are imported hereinto as part of the record hereof.

Finally it is to be understood that various alterations, modifications and/or additions may be incorporated into the various constructions and arrangements or parts without departing from the spirit and ambit of the invention.

Dated this 5th day of December, 2002.

SANDERCOCK & COWIE

PATENT ATTORNEYS FOR

ROD DAVIES INFRASTRUCTURE PTY. LTD.

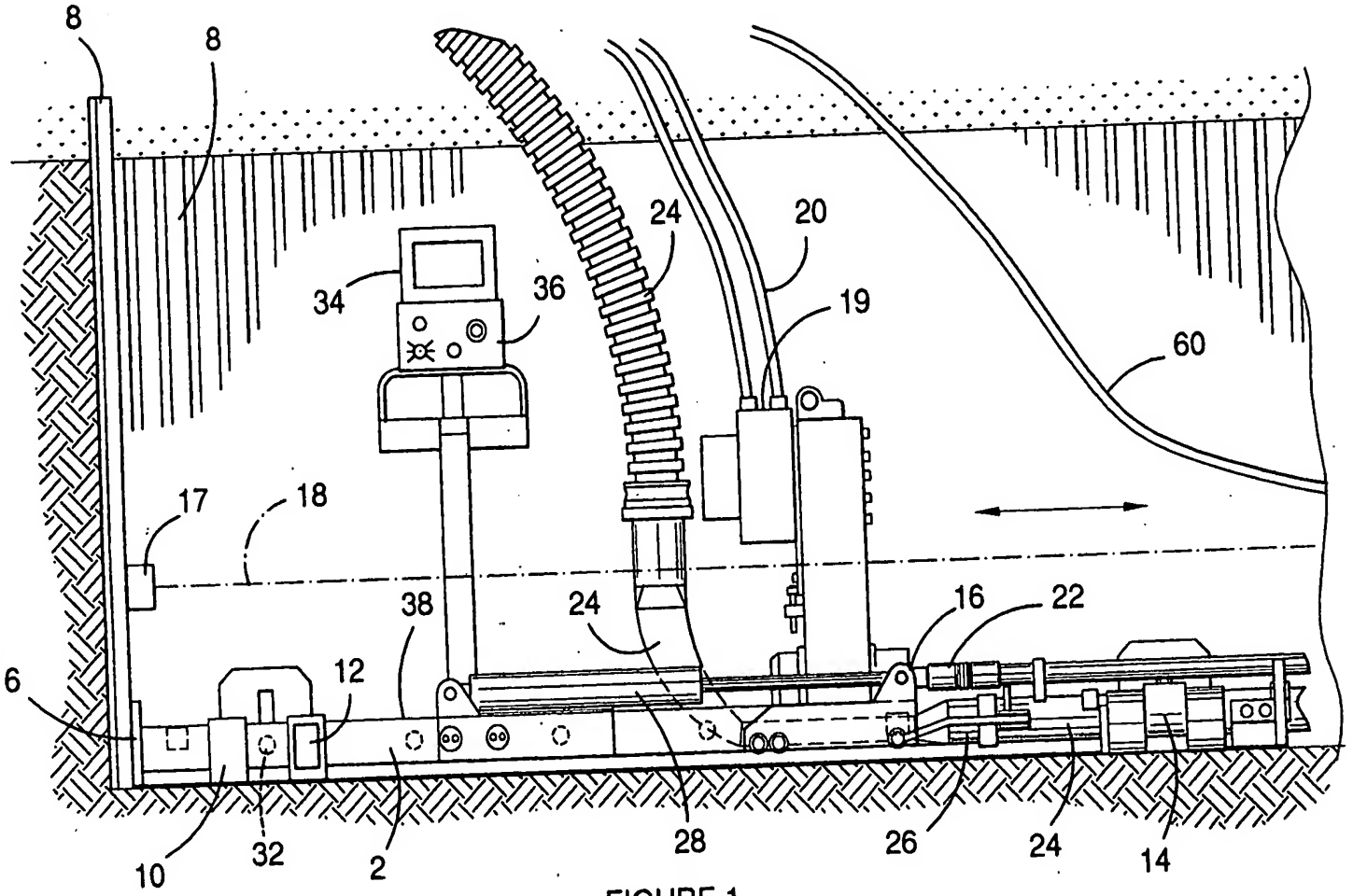

FIGURE 1

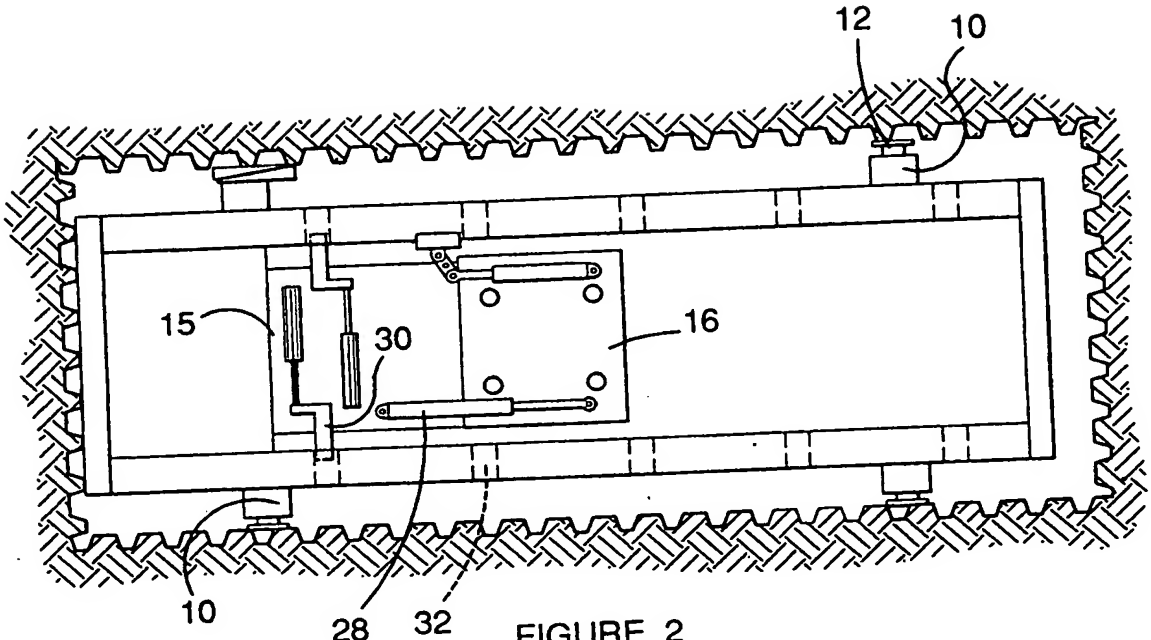

FIGURE 2

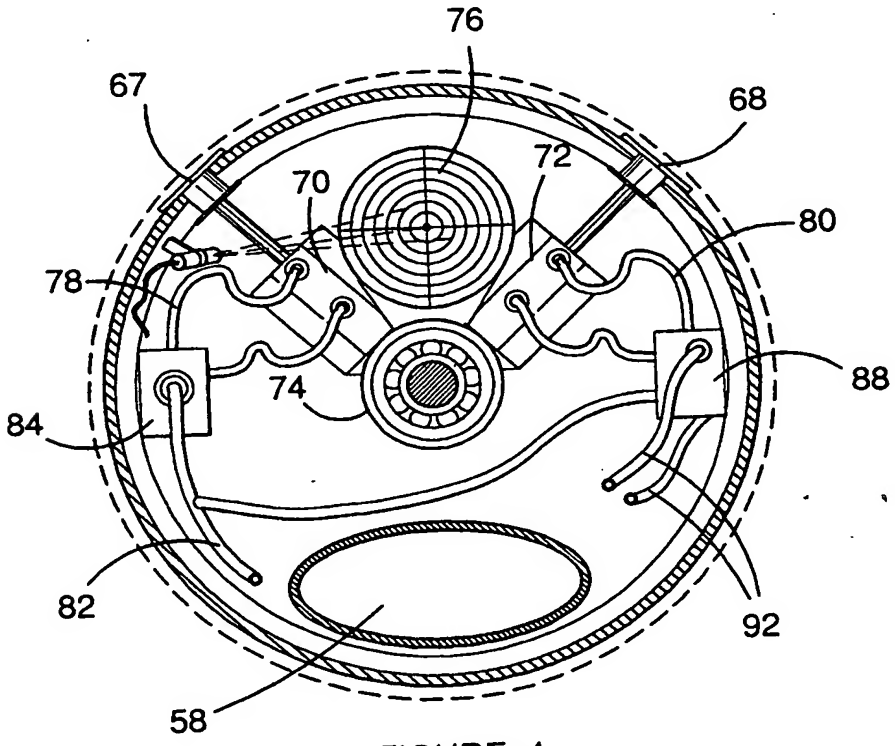

FIGURE 4

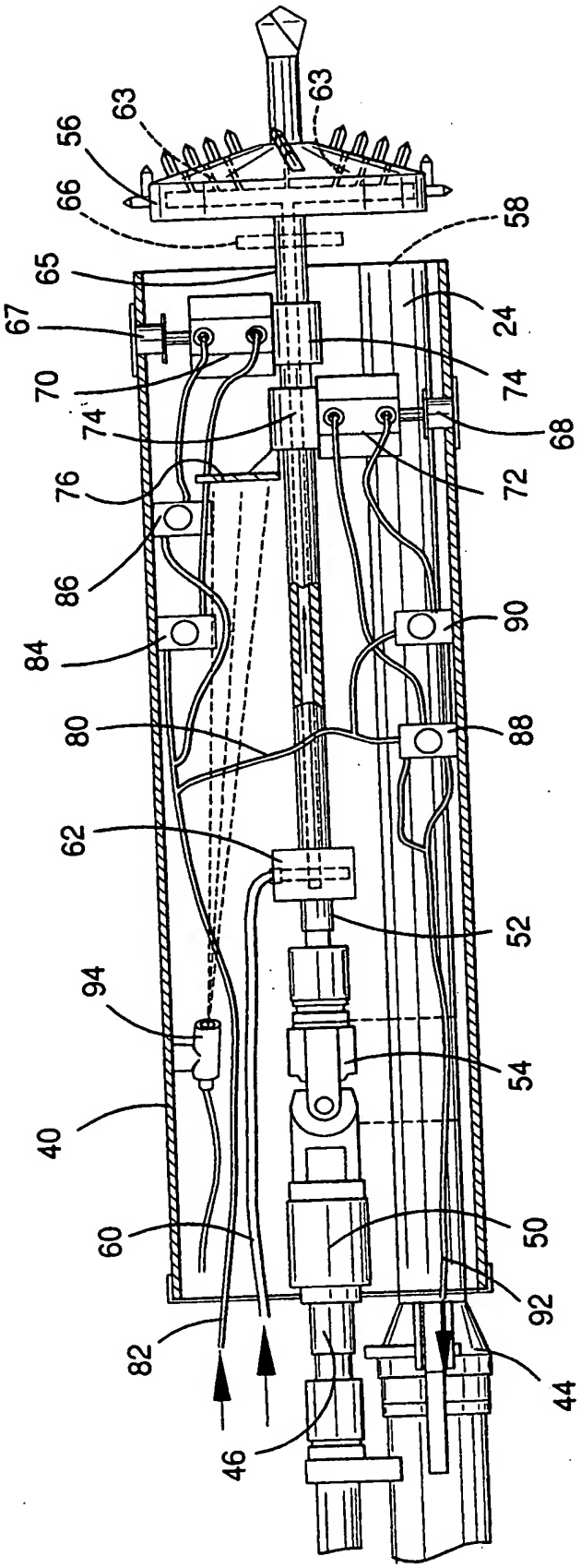
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FIGURE 3

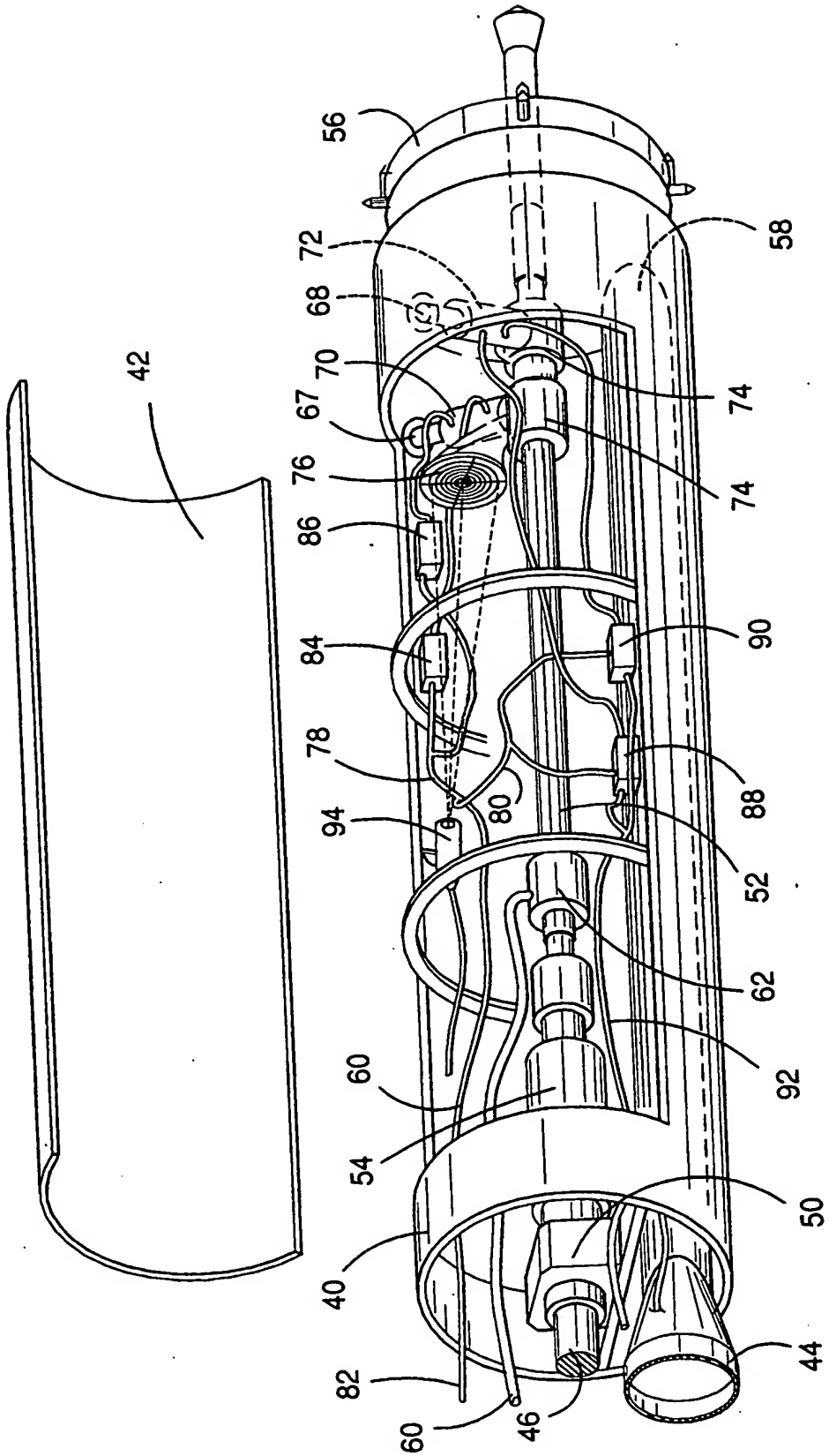
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FIGURE 5